THE FERNS and FERN ALLIES
of INDIANA

By

CHARLES C. DEAM

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DIVISION OF LANDS AND WATERS
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Ferns

1. Botrychium virginianum
   Rattlesnake Fern
2. Woodsia obtusa
   Common Woodsia
3. Cystopteris bulbifera
   Bulblet Fern
4. Cystopteris fragilis protusa
   Brittle Fern
5. Phegopteris ~~polypodioides~~
   (longer than wide)

PTERIDÓPHYTA. FERNS and FERN ALLIES

Note: Ferns and their allies have always been an attractive subject of study and many persons have made intensive studies of them and have designated many of the minute differences by special names. No attempt has been made here to evaluate the status of these variations and the common interpretation of them has been accepted.

In this treatment the term frond is used to mean the expanded portion of the leaf of a fern.

[Students who wish to use the stipe to assist in the determination of the ferns are referred to "An analytical key for the ferns of the Northeastern States, based on the stipes," by C. E. Waters, published in 1903 and republished as a supplement to the American Fern Journal, vol. 18: no. 2. 1928.]

1. OPHIOGLOSSÀCEAE Presl ADDER'S TONGUE FAMILY*

Sporangia cohering in a simple spike; fronds (leaves) one, rarely 2 or 3, entire; veins reticulate.....1. OPHIOGLOSSUM, p. 37.

Sporangia in pinnate or compound spikes, rarely in a simple spike but not cohering; fronds (leaves) not simple; veins free.....2. BOTRYCHIUM, p. 38.

1. OPHIOGLÓSSUM [Tourn.] L. ADDER'S TONGUE

Fronds mostly rounded or obtuse at the apex, rarely acute but never apiculate..... ..... 1. *O. vulgatum.*

Fronds more or less acute at the apex and apiculate.....2. *O. Engelmanni.*

1. **Ophioglossum vulgàtum** L.** COMMON ADDER'S TONGUE. Map 1. Local in various habitats in the southern half of the state. It is always found in dense shade and most commonly associated with beech, especially in low beech and sweet gum woods. Ordinarily it seems to prefer a slightly acid soil. It has been found in Lake County by several collectors, where it is evidently rather frequent. I have a specimen collected by Edwin D. Hull near Liverpool, Lake County, which was growing under some shrubs in almost pure sand with cranberry. Mr. Hull found more than 30 fruiting specimens at this time at the place mentioned above. Besides the counties shown on the map it has been reported from Crawford, Harrison, and Wayne Counties.

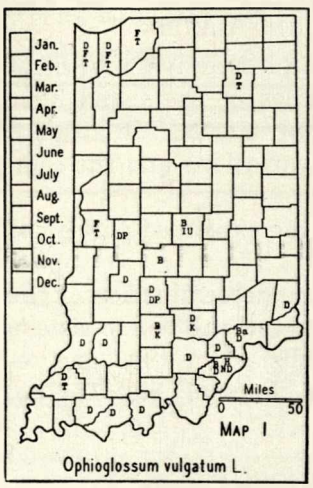
Markle (Proc. Indiana Acad. Sci. 1915: 357. 1916) in 1914 found near Gary, Lake County, many plants with more than one leaf. He reports "of a total of two hundred plants, selected at random, ninety-one had one leaf above ground, one hundred and five had two leaves, and four had three leaves".

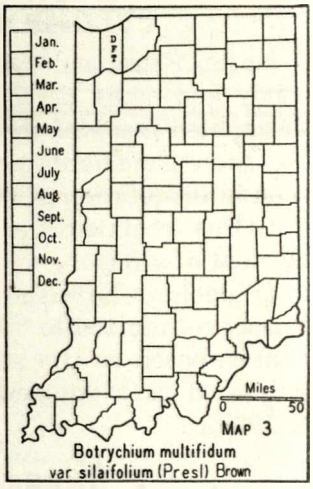
1a. **Ophioglossum vulgatum** f. **pseudópodum** Blake. (Rhodora 15: 87. 1913.) This is a form in which the sterile blade is narrowed below into a stalklike base a fourth to two thirds as long as the expanded portion. This form has been found in St. Joseph County by R. M. Tryon, Jr.

P. E. I., Ont. to Alaska, southw. to Fla. and Mex.; also in Eurasia.

* R. T. Clausen checked the determination of all my specimens and rendered valuable help.

** For a discussion of this species and varieties see Rhodora 41:494-499. 1939.





2. **Ophioglossum Engelmánni** Prantl. There is a fragmentary specimen in the herbarium of the New York Botanical Garden which R. T. Clausen has seen and reported in the Mem. Torrey Club **19**: no. 2:140. 1938 as belonging to this species. Clausen in a letter to me dated June 1, 1938, confirms his examination of the specimen and determination. The specimen was collected by L. M. Underwood in June, 1893, on the campus of Indiana University.

Nw. Va., s. Ohio and Ill. to Mo., southw. to cent. Fla., La., Tex., and Ariz.; cent. and s. Mex.

2. BOTRÝCHIUM Sw. GRAPEFERN

Fronds small, mostly 1-3 cm long, simple and roundish or pinnately 3-7-lobed.....1. *B. simplex.*

Fronds larger, more than 3 cm long, ternate.

Fronds on long petioles (arising from near the base of the stem), bipinnate-pinnatifid.

Sterile frond with all the segments of about the same size and shape; segments ovate or obovate, the terminal ones not elongate.....2. *B. multifidum* var. *silaifolium.*

Sterile fronds with segments of different size and shape.

Ultimate divisions of the frond cut into linear segments; segments more or less notched at the apex.....3. *B. dissectum.*

Ultimate divisions of the frond not dissected but variously and unevenly cut.

Divisions of the pinnae oblong-ovate to oblong-lanceolate, more or less acute.

Segments of frond many more than 9.....3a. *B. dissectum* var. *obliquum.*

Segments usually about 9.....3b. *B. dissectum* var. *tenuifolium.*

Divisions of the pinnae broadly ovate and obtuse.....3c. *B. dissectum* var. *oneidense.*

Fronds sessile (arising from near or above the middle of the stem), the short-stalked primary divisions once or twice pinnate and these in turn once or twice pinnatifid.....4. *B. virginianum.*

1. **Botrychium símplex** E. Hitchcock. HITCHCOCK GRAPEFERN. Map 2. I have seen specimens from three collections. The first was collected in 1910 by W. N. Clute along the Michigan Central Railroad near Glen Park, Lake County. A second specimen was collected in 1929 by Marcus W. Lyon, Jr., on the wooded border of an interdunal flat in Porter County. R. T.

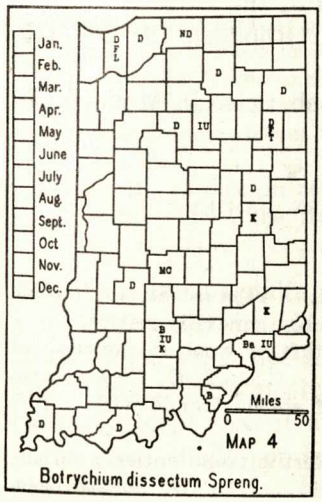
Clausen has seen this specimen and confirms the identification. The third was collected by J. A. Nieuwland at Dune Park, Porter County.

P. E. I. to Pa., westw. to Oreg. and Calif.

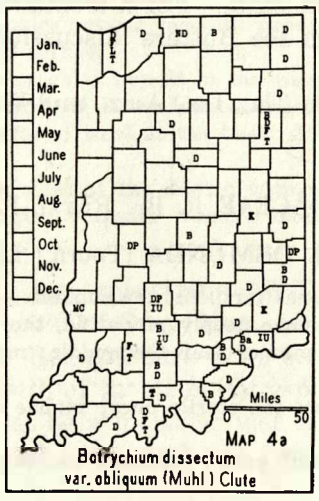
2. **Botrychium multífidum** (Gmel.) Rupr. var. **silaifòlium** (Presl) Broun. (*Botrychium ternatum* var. *intermedium* D. C. Eaton.) Map 3.

This report is based upon specimens collected by Marcus Lyon, Jr., and R. M. Tryon, Jr., in the Dunes State Park, Porter County. Tryon reported his specimens as *Botrychium dissectum* f. *elongatum*. R. T. Clausen and E. T. Wherry have seen these specimens and refer them to this species.

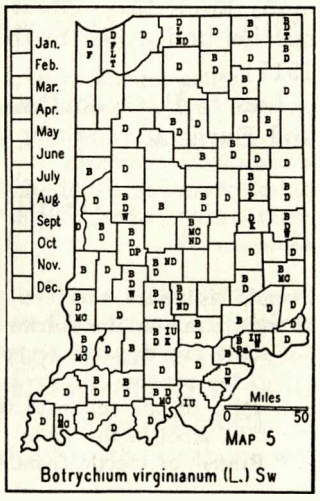
Maine to Que., and B. C., southw. to N. J. and Oreg.



MAP 4
Botrychium dissectum Spreng.



MAP 4a
Botrychium dissectum
var. obliquum (Muhl.) Clute



MAP 5
Botrychium virginianum (L.) Sw

3. **Botrychium dissèctum** Spreng. (*Botrychium obliquum* var. *dissectum* (Spreng.) Clute.) CUTLEAF GRAPEFERN. Map 4. Local throughout the state in either dry or moist soils. All of my specimens are from woodland; some are from white oak woods, some are from beech and sugar maple woods, and one specimen was found associated with sweet gum and white elm.

N. B. and N. S. to Minn., southw. to Fla., Mo., Ark., and Mex.

3a. **Botrychium dissectum** var. **obliquum** (Muhl.) Clute. (*Botrychium obliquum* Muhl.) OBLIQUE GRAPEFERN. Map 4a. Infrequent throughout the state in wet or dry woodland. Most of my specimens were found in low, flat woods associated with sweet gum and beech, and a few were found in dry woodland with beech and sugar maple.

A form with less divided and oblong pinnae has been described by E. W. Graves (Amer. Fern Jour. 22: 50-52. 1932) as *Botrychium obliquum* var. *oblongifolium*. Graves named one of my specimens from Marion County and one from Crawford County as belonging to this variety. Since fern students are not agreed upon the status of this fern, I record the data without comment.

N. B. to Minn., southw. to Fla., Mo., and Tex.

3b. **Botrychium dissectum** var. **tenuifòlium** (Underw.) Farw. I have a specimen of this variety collected in a low woods about 3 miles northwest of Leavenworth, Crawford County, which is referred to this variety by both R. T. Clausen and E. T. Wherry. This variety is found chiefly in the southern states.

3c. **Botrychium dissectum** var. **oneidénse** (Gilbert) Farw. According to Clausen's determination this variety occurs in De Kalb, Howard, Porter, and Steuben Counties.

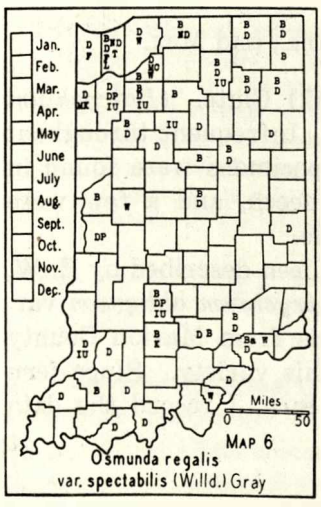
4. **Botrychium virginiànum** (L.) Sw. RATTLESNAKE FERN. Map 5. This is strictly a woodland species and is found in moist, rich woods of many kinds throughout the state. For a treatment of the varieties of this species and a key to them see Butters' discussion (Rhodora **19**: 207-215. 1917).

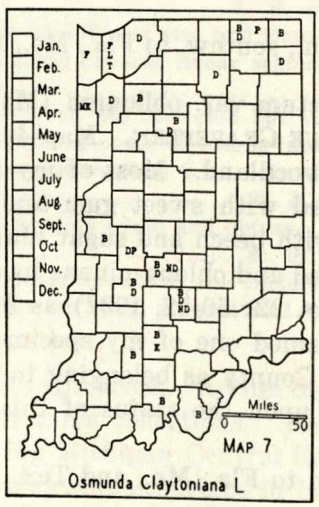
Lab. to B. C., southw. to Fla., La., Ariz., and Wash.; also in Mex., W. I., and Eurasia.

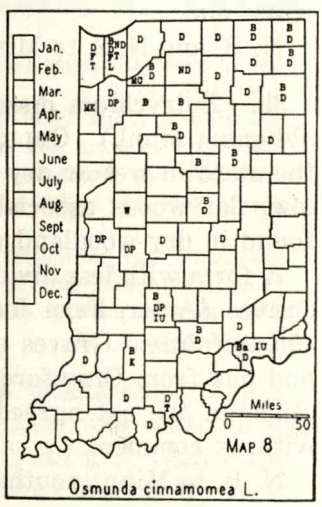
2. OSMUNDÀCEAE R. Br. ROYAL FERN FAMILY

1. OSMÚNDA [Tourn.] L.

Fronds bipinnate, the fertile ones fertile at the summit...1. *O. regalis* var. *spectabilis.*
Fronds pinnate, the sterile pinnae deeply pinnatifid, the lobes generally entire.
Fertile fronds with fertile pinnae near the middle; no tuft of wool at the base of the pinnae .....2. *O. Claytoniana.*
Fertile fronds separate from the sterile ones; pinnae of sterile fronds with a tuft of wool in the axils.
Pinnae of sterile fronds with entire segments and the fertile frond entirely fertile. .....3. *O. cinnamomea.*
Pinnae with the basal segments on the lower side (or rarely on both sides) much elongated and deeply and sharply toothed, other segments normal or nearly so .....3a. *O. cinnamomea* f. *auriculata.*
Pinnae (at least some of them) of fertile fronds more or less sterile (usually the lower ones) .....3b. *O. cinnamomea* f. *frondosa.*
Pinnae (at least some of them) of sterile fronds with lobes more or less cut or pinnatifid .....3c. *O. cinnamomea* f. *incisa.*







SUPPLEMENTARY KEY FOR THE SEPARATION OF STERILE FRONDS OF SOME SPECIES THAT SUPERFICIALLY LOOK MUCH ALIKE.

In my early study of ferns I was not aware that sterile fronds could be identified. Sterile specimens of *Osmunda* and *Pteretis* much resemble each other and I had never been able to find the last named genus until I was able to identify the sterile specimen. Since that time I have found several colonies and I think if all of our fern students knew how to separate these genera that many more colonies of *Pteretis* would be found. Likewise there is a possibility that sterile specimens of *Woodwardia virginica* and certain species of *Athyrium* and *Dryopteris* might be confused with *Osmunda*. Hence this key.

Veins simple, not forked; pinnules entire; vascular bundles in stipe 7.....*Pteretis.*
Veins not simple, more or less forked.
Veins usually forked once; vascular bundle in the stipe 1; stipe stramineous.
Sterile fronds with tufts of wool at the base of the pinnae..*Osmunda cinnamomea.*
Sterile fronds without tufts of wool at the base of the pinnae.....
..... *Osmunda Claytoniana.*
Veins with areolae on both sides of the midrib with which simple or rarely forked veins connect the margin; vascular bundles more than 5; stipe dark brown.
..... *Woodwardia.*

1. **Osmunda regàlis** L. var. **spectábilis** (Willd.) Gray. (Rhodora 21: 179. 1919.) (*Osmunda regalis* of Gray, Man., ed. 7 and Britton and Brown, Illus. Flora, ed. 2, not L.) ROYAL FERN. Map 6. Frequent in the lake area and infrequent to local south of it. It is not especially particular as to its habitat except that it must be a moist or wet one. It is found mostly in low woods, about ponds and lakes, and less frequently in the open in wet prairies.

Newf. to Sask., southw. to Fla. and Miss.

2. **Osmunda Claytoniàna** L. INTERRUPTED FERN. Map 7. Infrequent to local throughout the greater part of the state. Besides the counties shown on the map, there are reports from thirteen additional counties. It seems to prefer the moist bases of black and white oak slopes. In the southern part of the state it is found on the slopes of deep, wooded ravines.

Newf. to Minn., southw. to N. C., Ky., and Mo.; a variety also in s. Asia.

3. **Osmunda cinnamòmea** L. CINNAMON FERN. Map 8. Frequent in the lake area, becoming infrequent to local south of it. In the lake area it is usually common in tamarack bogs and swamps about lakes, and in the southern part of the state it grows in low, flat woods, associated with sweet gum and red maple. Throughout its range it is found only in wet soil in bogs or about ponds and marshes and rarely on shaded slopes.

Newf. to Minn., southw. to Fla., La., and N. Mex.; also in Mex., S. A., W. I., and Eurasia.

3a. **Osmunda cinnamomea f. auriculàta** (Hopkins) Kittredge. (Bull. Conn. State Geol. and Nat. Hist. Surv. 48: 12. 1931.) This form has the basal segments much elongated and deeply and sharply toothed on the lower side or rarely on both sides. The other segments are normal or nearly so. It has been found in Porter County by R. M. Tryon, Jr.

3b. **Osmunda cinnamomea** f. **frondòsa** (T. & G.) Britt. (Cat. Plants of New Jersey, p. 312. 1890.) This form has the fertile frond partly leafy, the fertile and sterile pinnae variously intermixed. I found this unusual form in Lagrange County and Nieuwland found it in St. Joseph County.

3c. **Osmunda cinnamomea** f. **incìsa** (Huntington) Gilbert. (List North American Pteridophytes, pp. 13, 28. 1901.) This form usually has acutely toothed or lobed segments. I found it in De Kalb County.

3. POLYPODIÀCEAE R. Br. FERN FAMILY

Fronds conspicuously dimorphic, the fertile ones with divisions greatly contracted or berrylike, brown when fully mature.
  Sterile fronds pinnatifid, the veins netted; fertile fronds bipinnate, the divisions berrylike.....4. ONOCLEA, p. 45.
  Sterile fronds bipinnatifid, the veins free; fertile fronds pinnate, the divisions linear, strongly ascending.....3. PTERETIS, p. 44.
Fronds not conspicuously dimorphic, all green.
  Sori marginal, the indusium appearing to consist of the reflexed margin of the segments of the frond or of a marginal cup.
    Fronds with sporangia borne in minute cuplike indusia near the notches of the segments, the sori separate; fronds bipinnate, the lower surface well covered with short, erect, glandular hairs.....7. DENNSTAEDTIA, p. 50.
    Fronds not as above.
      Stipes stout (2-4 mm in diameter), commonly solitary, green (stramineous or pale brown in dried specimens).....15. PTERIDUM, p. 57.
      Stipes less than 2 mm in diameter, commonly clustered (brown to blackish).
        Pinnules pubescent above and below with long, white hairs, densely so along the margins below.....13. CHEILANTHES, p. 56.
        Pinnules glabrous or with a few scattered hairs.
          Indusia of pinnules continuous; fronds coriaceous, pinnate or bipinnate. .....12. PELLAEA, p. 55.
          Indusia definitely interrupted on the fanlike margin of the pinnule; fronds delicate, branched at the summit, the branches definitely pinnate. .....14. ADIANTUM, p. 57.
  Sori dorsal, not marginal (except in *Dryopteris marginalis*).
    Sori and indusia (when present) more or less circular, or reniform.
      Fronds pinnate, pinnules narrowly oblong-lanceolate with an auricle at the base of the upper margin, the stipe and rachis thickly covered with scales; pinnules of fertile fronds contracted; sori confluent..6. POLYSTICHUM, p. 50.
      Fronds not as above.
        Stipe, rachis, and lower surface of the pinnae more or less glandular-puberulent; stipe and rachis deciduously chaffy.....1. WOODSIA, p. 43.
        Stipe, rachis, and lower surface of pinnae not, or not all, more or less glandular-puberulent.
          Fronds deeply pinnatifid, the divisions confluent at the base; sori naked; blades of fronds coriaceous.....16. POLYPODIUM, p. 57.
          Fronds not as above.
            Indusia attached in the center or lacking, if lacking then the rachis pubescent and chaffy.....5. DRYOPTERIS, p. 45.
            Indusia attached by a broad base on the side toward the midrib and partly under the sori, opening on the opposite side...2. CYSTOPTERIS, p. 43.
    Sori elongated, oblong to linear, often curved.
      Sori in rows parallel to the midribs of the pinnae and along the midveins of the segments.....11. WOODWARDIA, p. 55.
      Sori not disposed as above.

Blades of fronds simple, long-attenuate at the apex, cordate at the base, entire or undulate.....9. CAMPTOSORUS, p. 53.
Blades once to several times divided.
Sori straight or slightly curved; fronds mostly 10-40 cm long.....
.....10. ASPLENIUM, p. 53.
Sori often curved over the ends of the veins; fronds mostly 35-90 cm long.
.....8. ATHYRIUM, p. 51.

1. WOÓDSIA R. Br. WOODSIA

1. **Woodsia obtùsa** (Spreng.) Torr. COMMON WOODSIA. Map 9. Infrequent to rare in the southern part of the state and very local northward to the counties shown on the map. Probably not found in Indiana north of the counties shown on the map. It no doubt occurs also in Wabash County but I have not been able to find it. It is usually found in shallow soil on rocky slopes. It prefers sandstone but is also found on limestone.

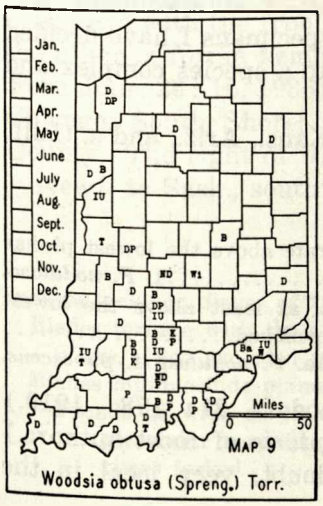
Cent. Maine to Wis., B. C., and Alaska, southw. to Ga., Ala., Tex. and Ariz.

2. CYSTÓPTERIS Bernh.

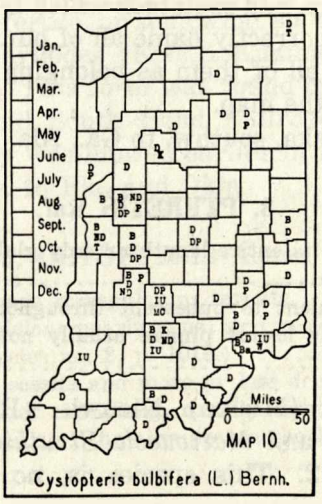
Fronds lanceolate, attenuate, often bulblet-bearing on the lower surface of the upper part; segments and teeth crowded; rachis not winged; pinnules mostly oblong, very obtuse; indusium truncate on the free side, minutely glandular.....
..... 1. *C. bulbifera.*
Fronds ovate or oblong-lanceolate, acute, not bulblet-bearing; segments and teeth more distant, decurrent on the slightly margined rachis; pinnules mostly oval, more pointed; indusium acute or acuminate, and often lacerate on the free side, not glandular .....2. *C. fragilis.*

1. **Cystopteris bulbífera** (L.) Bernh. (*Filix bulbifera* (L.) Underw.) BERRY BLADDER FERN. Map 10. Infrequent in the southern part of the state, becoming very local to absent in the northern part. This species grows only in wet places or places that are usually constantly kept moist in shady, rocky ravines and in pockets or crevices of shaded cliffs. It is usually found along the outlets of springs in southern Indiana. My Steuben County specimen was found in an old tamarack bog.

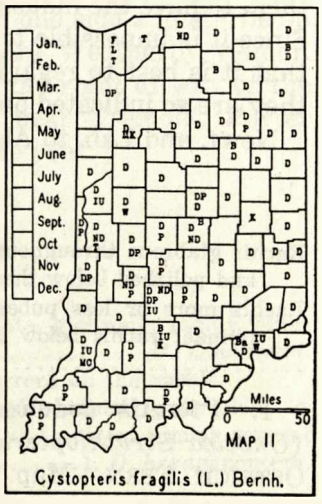
Newf. to Man., southw. to Ga., Ala., Ark., and Iowa.



Woodsia obtusa (Spreng.) Torr.



Cystopteris bulbifera (L.) Bernh.



Cystopteris fragilis (L.) Bernh.

2. **Cystopteris frágilis** (L.) Bernh. (*Filix fragilis* (L.) Underw.) BRITTLE FERN. Map 11. This species prefers the deep, rich leaf mold of beech and sugar maple and white oak woods and is frequent to common throughout the state south of the Wabash River where woods of this kind are found. North of the Wabash River it is infrequent to very rare. It is absent in the southern part of the state in the areas where low, flat woods occur. It is found in exposed places on sandstone ridges and bluffs.

Students sometimes find difficulty in distinguishing this species from *Woodsia obtusa*. The stipe of the last named species is covered more or less densely with short, stipitate glands while the stipe of *Cystopteris* is entirely glabrous or with only a few glands near the summit.

The *Cystopteris fragilis* species complex has been restudied by C. A. Weatherby. He has recently described a new variety to which, in my opinion, all or most all of our specimens belong. It is described as follows:

"**Cystopteris fragilis** (L.) Bernh. var. **protrùsa** Weatherby. (Rhodora 37: 373-375. 1935.) Rootstock creeping, only sparsely beset with bases of old fronds, the growing point hardly paleaceous, produced 2-4 cm beyond the fronds of the season; well-developed blades nearly bipinnate-pinnatifid, 11-22 cm long, 5-11.5 cm wide, pinnae ovate to ovate-lanceolate, acute, pinnules toward the base of the pinnae deltoid-ovate to ovate-lanceolate, subacute, usually shortly but distinctly petiolulate, deeply pinnatifid into oblong, obtuse lobes; in juvenile or depauperate blades less lobed and more obtuse; indusium about 0.5 mm long, shallowly lobed or nearly entire at apex. Southern New York, south in the piedmont and the mountains to Alabama, west to Minnesota and Missouri."

My specimens have been examined by two fern specialists and they agree that most of them belong to this variety and some can not be determined with certainty.

A form of this species with large, abundant sori has been named f. **magnasora** Clute (Fern Bull. 9: 65. 1901).

The true species has a range to the north of Indiana. In order to refer specimens to their correct variety and form it is usually necessary for them to have the indusium and rootstock which most of our specimens lack. Since it is impossible to correctly name all of our specimens I have decided that it is best to regard all of them as belonging to a species complex and they are so indicated on the map.

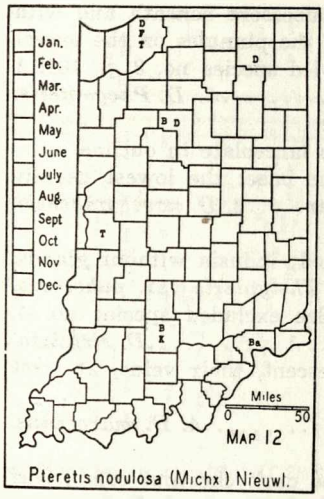
Newf. and Lab. to Alaska, southw. to Ga., Ala., Kans., Ariz., and s. Calif.

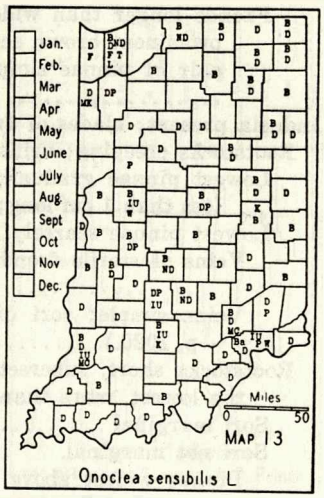
3. PTERÈTIS Raf.

Rachis glabrous throughout its entire length or only glabrate above the lowest pinnae and polished below them.....1. *P. nodulosa.*

Rachis more or less puberulent to pubescent throughout, at least above the lowest pinnae; rachis below the lowest pinnae usually not polished.....1a. *P. nodulosa* f. *pubescens.*

1. **Pteretis nodulòsa** (Michx.) Nieuwl. (Rhodora 21: 178. 1919.) (*Onoclea Struthiopteris* and *Matteuccia Struthiopteris* of most authors.) OSTRICH FERN. Map 12. This species is, no doubt, very local in the





state although it may have been overlooked because of its close resemblance to *Osmunda cinnamomea*. My specimens are mostly from alluvial flood plains of small streams.

Newf. to B. C., southw. to Va. and Iowa.

1a. **Pteretis nodulosa** f. **pubéscens** (Terry) Fern. (Rhodora 37: 219. 1935.) Map 12a. This form is not well marked in Indiana.

4. ONOCLÈA L.

1. **Onoclea sensíbilis** L. SENSITIVE FERN. Map 13. Frequent throughout the state in low places in woodland, about lakes, and along roadsides.

Forma **obtusilobàta** (Schkuhr) Gilbert is a form with fronds intermediate between the normal fertile and normal sterile phases, bipinnate or nearly so, the pinnules flat and nearly free-veined, rarely partly fertile. This form has been found in Porter County by R. M. Tryon, Jr., who says it is not infrequent in meadows that have been mowed in the early part of the year. There is a specimen from Porter County in the herbarium of the University of Notre Dame.

A form with the frond fertile, or somewhat so, on one side and sterile on the other is forma **hemiphyllòdes** (Kiss & Kümmerle) Weatherby (Amer. Fern Jour. 26: 16. 1936). This form was found on the right of way of the Chicago, South Shore, and South Bend Railroad near Tremont, Porter County. The right of way was mowed earlier in the year.

Newf. to Sask., southw. to Fla. and Okla.

5. DRYÓPTERIS Adans.

Indusia lacking; blades of fronds triangular or ternate.
- Blades ternate with the divisions nearly equal and petiolate, glabrous; rachis wingless. (See excluded species no. 2, p. 1019.) ..... *D. Linnaeana.*
- Blades bipinnatifid; pinnae sessile and more or less decurrent on the rachis.
  - Fronds as wide as or wider than long, usually light green, finely puberulent or glandular beneath; veins of the pinnules on the lowest pair of pinnae several times forked ..... 1. *D. hexagonoptera.*

Fronds longer than wide, dark green, more coarsely pubescent beneath and with prominent brown scales along the rachis; veins of the pinnules on the lowest pair of pinnae simple or once forked. (See excluded species no. 3, p. 1019.) ..... *D. Phegopteris.*

Indusia present; blades of fronds not triangular or ternate.

Rootstocks creeping; veins simple or once forked; fronds lanceolate in outline.

Lowest pinnae gradually decreasing in size toward the base; the lowest usually less than 1 cm long; veins simple; indusia glandular.....2. *D. noveboracensis.*

Lowest pinnae scarcely smaller than the middle ones.

Veins of sterile fronds generally forked; sori crowded; indusia without glands. .....3. *D. Thelypteris* var. *pubescens.*

Veins simple; sori distant; indusia glandular. (See excluded species no. 4, p. 1020.) .....*D. simulata.*

Rootstocks short, suberect; fronds cespitose, never pubescent, their veins, at least the lowest, more than once forked.

Sori marginal .....4. *D. marginalis.*

Sori not marginal.

Pinnae widest above the base; basal scales of stipe dark chestnut color; sori mostly 3-7 pairs; the largest fern of the genus (in Indiana)..5. *D. Goldiana.*

Pinnae widest at the base; basal scales of stipe not so dark colored as the preceding.

Surface of indusium glabrous.

Fronds bipinnatifid or pinnate.

Basal scales of stipe lance-linear, caudate-attenuate; segments with parallel sides, serrate at the rounded apex and obscurely so, if at all, on the sides, the teeth rarely somewhat spinulose; sori usually on the lower half of the segment. (See excluded species no. 5, p. 1020.) .....*D. Filix-mas.*

Basal scales of stipe wider; teeth of segments more or less spinulose; sori not restricted to the lower half of the segment.

Fronds linear-oblong or lanceolate in outline; pinnae 5-8 cm long, triangular-oblong or the lowest pair somewhat triangular-ovate, usually the lower half of the frond conspicuously decreasing in size toward the base.....6. *D. cristata.*

Fronds wider; pinnae 8-15 cm long, oblong-lanceolate, the lower half of the frond not decreasing in size toward the base..... .....6a. *D. cristata* var. *Clintoniana.*

Fronds bipinnate, tripinnate, or tripinnatifid, segments with spinulose teeth.

Basal inferior and superior pinnules of the lowermost pinnae subopposite, rarely more than 4 mm apart; the inferior 1-6 cm long, if more, then twice as long as the superior; pinnules of the middle pinnae often only toothed; pinnules pinnatifid or pinnate.....7. *D. spinulosa.*

Basal inferior and superior pinnules of the lowest pinnae remote, 0.5-2 cm wider apart; the inferior 3-10 cm long, 2-4 times as long as the superior; pinnules pinnatifid or pinnate. (See excluded species no. 7, p. 1020.) .....*D. spinulosa* var. *americana.*

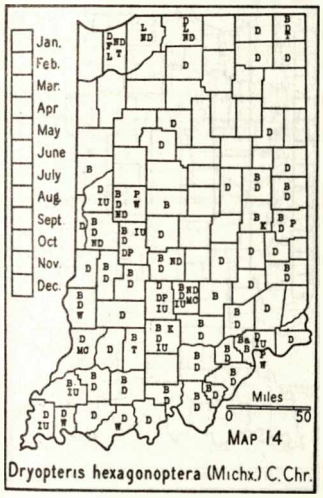
Surface of indusium glandular.

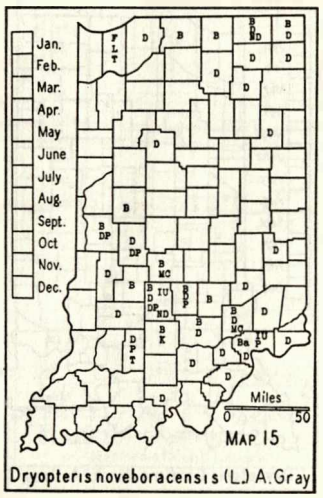
Frond commonly minutely glandular especially on the rachis and rachillae, tripinnatifid or sometimes tripinnate; pinnae slightly ascending to divergent, the basal inferior pinnule shorter than to rarely exceeding the second inferior one; scales of stipe usually dark brown at base.

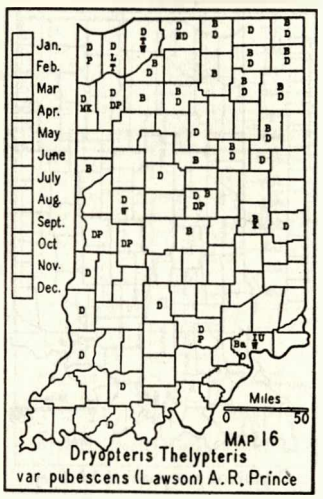
Mature indusium 0.8-1.4 mm wide; pinnae gradually tapering to apex. .....7a. *D. spinulosa* var. *fructuosa.*

Mature indusium 0.5-0.8 mm wide; pinnae usually narrowed rather abruptly to prolonged lance-linear tips..... .....7b. *D. spinulosa* var. *intermedia.*

Frond not minutely glandular but more or less chaffy, bipinnate or tripinnatifid .....8. ***D. Boottii.***







1. **Dryopteris hexagonóptera** (Michx.) C. Chr. (*Phegopteris hexagonoptera* (Michx.) Fée.) WINGED WOODFERN. BROAD BEECHFERN. Map 14. Frequent in the southern half of the state, becoming less frequent northward and even rare in some of our northern counties. This is a woodland species found in all kinds of dry soils. It is found more frequently associated with black and white oak and only occasionally with beech and sugar maple.

Cent. Maine to w. Que. and Minn.; southw. to Fla., La., Iowa, and Okla.

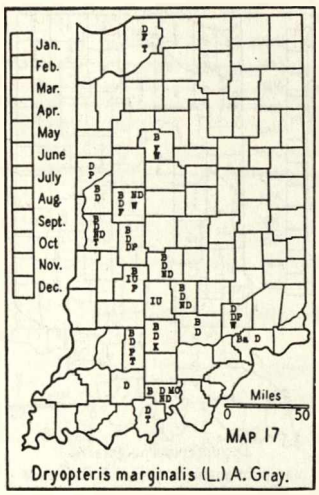
2. **Dryopteris noveboracénsis** (L.) A. Gray. (*Aspidium noveboracense* (L.) Sw.) NEW YORK FERN. Map 15. This species is found only in slightly acid soil, hence its zonal distribution. It is infrequent to local in the northern part of the state where it usually occurs in black and white oak woods. It is rare or absent in the Tipton Till Plain, becoming infrequent to frequent southward in the hard, white clay soil of beech and sweet gum woodland. In the southern part of the state is is usually closely associated with beech.

Newf. to Ont. and Minn., southw. to Ga., Ala., and Ark.

3. **Dryopteris Thelýpteris** (L.) A. Gray var. **pubéscens** (Lawson) A. R. Prince. (*Aspidium Thelypteris* of Gray, Man., ed. 7, not Sw.; *Dryopteris Thelypteris* of Britton and Brown, Illus. Flora, ed. 2, not A. Gray; and *Thelypteris palustris* of authors, not Schott.) MARSHFERN. Map 16. Common in the lake area and infrequent south of it. In the lake area it is common in tamarack bogs, sedge marshes, and on the low borders of lakes. South of this place it is found in springy and marshy areas.

Se. Newf., Que. to Man., southw. to Ga., Tenn., and Okla.

4. **Dryopteris marginàlis** (L.) A. Gray. (*Aspidium marginale* (L.) Sw.) LEATHER WOODFERN. Map 17. This species is, for the most part, restricted to the outcrops of sandstone or nearby residual soils which are the product of sandstone in the southern part of the state. Most of my



Dryopteris marginalis (L.) A. Gray.

Dryopteris Goldiana (Hook.) A. Gray.

Dryopteris cristata (L.) A. Gray.

specimens are from wooded bluffs and slopes along streams. In addition to my collections, it has been reported from Clark, Floyd, Monroe, and Vigo Counties. It has been reported also from the dune area, and on May 30, 1935, R. M. Tryon, Jr. showed me large colonies of it on a north, wooded slope in Memorial Park about a mile east of Michigan City. It is, without question, a native here.

A form in which the pinnae are toothed or lobed has been named and has been reported from Indiana. I have a few specimens with some of the pinnae toothed but I do not think it is worth while to name such minor fluctuations.

N. S. to B. C., southw. to Ga., Ala., Ark., Kans., and Okla.

5. **Dryopteris Goldiàna** (Hook.) A. Gray. (*Aspidium Goldianum* Hook.) GOLDIE FERN. Map 18. Infrequent to rare throughout the state in deep humus, usually on the slopes of wooded ravines.

Cent. Maine to Minn., southw. to N. C., Tenn., and Iowa.

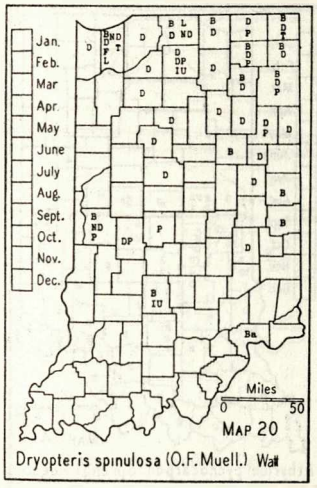
×**Dryopteris Goldiana** × **marginalis** Dowell. This hybrid was found in Martin County by R. M. Tryon, Jr. (Amer. Fern Jour. 28: 74. 1938.)

5. **Dryopteris Goldiàna** (Hook.) A. Gray. (*Aspidium Goldianum* CRESTED WOODFERN. Map 19. This species is restricted nearly to the lake area where it is frequent in tamarack bogs and in low woods, usually in masses of decaying organic matter. There are, however, reports of it from Grant, Howard, and Monroe Counties.

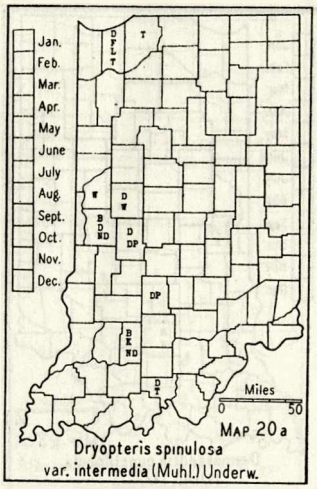
Newf. to Sask., southw. to N. C.

6a. **Dryopteris cristata** var. **Clintoniàna** (D. C. Eaton) Underw. (*Aspidium cristatum* var. *Clintonianum* D. C. Eaton and *Dryopteris Clintoniana* (D. C. Eaton) Dowell.) CLINTON WOODFERN. My only specimens of this fern are my no. 47776 from La Porte County and one collected by Tryon in Porter County.

N. H. to Wis., southw. to N. C.



MAP 20
Dryopteris spinulosa (O.F. Muell.) Wall



MAP 20a
Dryopteris spinulosa
var. intermedia (Muhl.) Underw.

MAP 21
Dryopteris Boottii (Tuckerm.) Underw.

×**Dryopteris cristata** × **spinulòsa** C. Chr. is a closely allied form which is represented in my collection by a single specimen. It is my no. 54091 from Lagrange County, which was determined by C. A. Weatherby.

7. **Dryopteris spinulòsa** (O. F. Muell.) Watt. (*Aspidium spinulosum* (O. F. Muell.) Sw.) (Amer. Fern Jour. **26**: 65-69. 1936.) TOOTHED WOODFERN. Map 20. The greater number of specimens are from the lake area where it is usually frequent in wet woods, especially about ponds, in tamarack bogs, and on the wet, wooded borders of lakes. Sometimes it is found in dry woods after the water level has been lowered. This is one of our commonest and most attractive ferns. It usually grows in clusters of from 5 to 10 fronds.

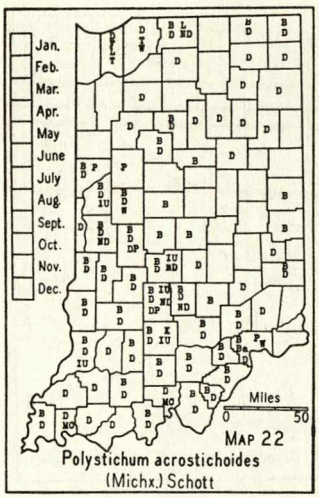
Lab. to the Selkirks and Idaho, southw. to Va. and Ky.

7a. **Dryopteris spinulosa** var. **fructuòsa** (Gilbert) Trudell. (Rhodora 28: 146. 1926.) My specimens are from tamarack bogs and very low woods. I have no data concerning its general distribution.

7b. **Dryopteris spinulosa** var. **intermèdia** (Muhl.) Underw. (Rhodora 21: 178. 1919 and Rhodora 22: 196. 1920.) (*Aspidium spinulosum* var. *intermedium* (Muhl.) D. C. Eaton and *Dryopteris intermedia* (Muhl.) Gray.) COMMON WOODFERN. Map 20a. I have only a few specimens of this fern although it has been reported from 10 counties not shown on the map. It has a wide distribution in the state and seems to favor wooded ravines.

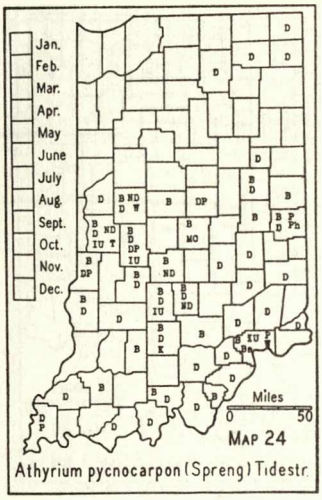
Newf. to Wis., southw. to N. C. and Mo.

8. ×**Dryopteris Boòttii** (Tuckerm.) Underw. (*Aspidium Boottii* Tuckerm.) BOOTT WOODFERN. Map 21. I reported this fern from Noble and Wells Counties but I now refer my specimens to other species. R. M. Tryon, Jr. has found it in La Porte and Porter Counties. His determinations have been checked by fern specialists. This species is regarded by some fern



MAP 22
Polystichum acrostichoides (Michx.) Schott

MAP 23
Dennstaedtia punctilobula (Michx.) Moore



MAP 24
Athyrium pycnocarpon (Spreng.) Tidestr.

students as a hybrid between *Dryopteris cristata* and *Dryopteris spinulosa* var. *intermedia.*

N. S. to Minn., southw. to Va.

6. POLÝSTICHUM Roth

1. **Polystichum acrostichoìdes** (Michx.) Schott. CHRISTMAS FERN. Map 22. This is a woodland species preferring the lower part of the slopes of deep wooded ravines. It is infrequent to rare in some of the northern counties, becoming frequent to common in the southern half of the state, especially among the hills. In protected places in the southern part of the state it is evergreen.

N. S. to Ont. and Wis.; southw. to Ga. and Tex.

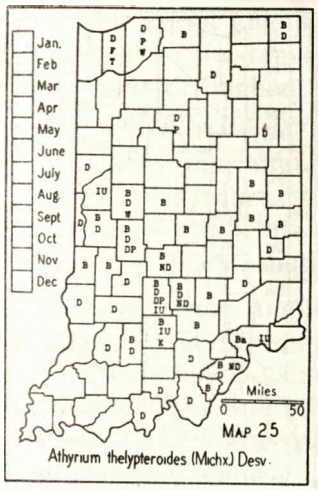
1a. **Polystichum acrostichoides** f. **incìsum** (Gray) Gilbert. (*Polystichum acrostichoides* var. *Schweinitzii* (Beck) Small.) I have a specimen of this form from Daviess County. It has, however, been reported from several other counties throughout the state.

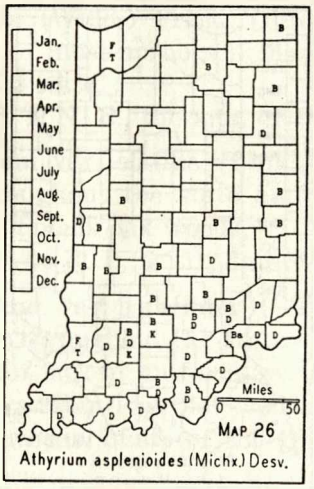
1b. **Polystichum acrostichoides** f. **crìspum** Clute. This is a form with the margins of the pinnae crisped and ruffled. It has been found by R. M. Tryon, Jr. in Porter County.

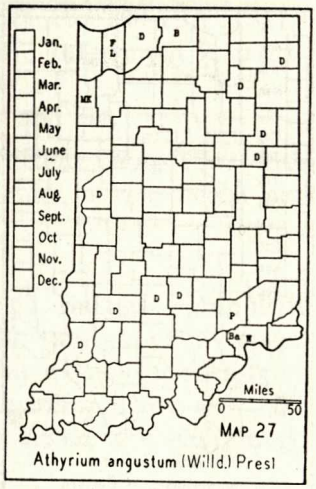
7. DENNSTAÈDTIA Bernh.

1. **Dennstaedtia punctilóbula** (Michx.) Moore. (*Dicksonia punctilobula* (Michx.) Gray.) HAY-SCENTED FERN. Map 23. This fern seems to be rare in the state. It prefers the sandstone and shaly rocks of deep, wooded ravines. Williamson, in "Ferns of Kentucky," says it was found along Silver Creek north of Louisville, Kentucky. It was rather common in a rocky ravine in Turkey Run State Park. Outside of Indiana in suitable habitats it often becomes an annoying weed in pastures.

N. S. to Minn., southw. to Ga. and Mo.







8. ATHÝRIUM Roth

[Butters. The genus Athyrium and the North American ferns allied to Athyrium Filix-femina. Rhodora 19: 170-197. 1917. Pinkerton. Ferns of Missouri. Ann. Missouri Bot. Gard. 20: 54-57. 1933.]

Fronds pinnate.

Pinnae entire.....1. *A. pycnocarpon.*

Pinnae deeply pinnatifid.....2. *A. acrostichoides.*

Fronds bipinnate.

Rhizomes creeping, not densely covered with persistent bases of old fronds; stipe usually about as long as the blade; scales of stipes very few, rarely persistent, yellowish brown or tawny; blades widest near the base; young indusia with glandular cilia; spores somewhat nigrescent, wrinkled.....3. *A. asplenioides.*

Rhizomes horizontal, completely concealed by thick, fleshy bases of old fronds; stipe about half as long as the blade; scales of stipes varying from Mars Brown (Ridgway Standard) to nearly black; blades widest near the middle, the lower pinnae shorter and often deflexed; indusia toothed or short-ciliate, never glandular; spores yellow, smooth or slightly papillate.

Sori confluent at maturity and usually covering the lower side of the fertile pinnules; fertile frond contracted.

Longest pinnae of fertile frond 5-12 cm long; pinnules 4-12 mm long; pinnules of sterile fronds oblong, obtuse, slightly toothed or lobed...4. *A. angustum.*

Longest pinnae of fertile frond 1-2 dm long; pinnules 12-25 mm long, pinnatifid; sori several on each of the lower segments, often horseshoe-shaped; pinnules of sterile fronds oblong-lanceolate, strongly toothed or pinnatifid, somewhat acute.....4a. *A. angustum* var. *elatius.*

Sori usually separate and distinct at maturity; fertile fronds not contracted; pinnules lanceolate, subacute, strongly toothed or pinnatifid, the segments toothed.....4b. *A. angustum* var. *rubellum.*

1. **Athyrium pycnocárpon** (Spreng.) Tidestr. (*Asplenium angustifolium* Michx. and *Asplenium pycnocarpon* Spreng.) NARROWLEAF SPLEENWORT. Map 24. Infrequent to frequent in southern Indiana, becoming less frequent to rare northward. It prefers deep humus and is most commonly found on the slopes of ravines in beech woods.

W. Que to Wis., southw. to Ga., Ala., Mo., and Kans.

2. **Athyrium thelypteroides** (Michx.) Desv. (*Asplenium acrostichoides* Sw. and *Athyrium acrostichoides* (Sw.) Diels.) SILVERY SPLEENWORT. Map 25. Infrequent in southern Indiana, becoming rare in the northern part. It prefers a moist, deep humus soil in ravines and protected places in beech and sugar maple or white oak woods.

N. S. to Minn., southw. to Ga., Ala., and Mo.; also in Asia.

3. **Athyrium asplenioides** (Michx.) Desv. Map 26. This species and the next species and its varieties are the results of dividing an aggregate that formerly had been designated as *A. Filix-femina.* For a detailed study of this group see Butters' "Synoptical treatment of the Lady Ferns of Eastern North America" (Rhodora **19**: 188-197. 1917). Butters has gone into great detail in his study of the species and discusses "sun" and "shade" forms. Some recent authors are disposed to regard some of the forms as merely ecological variations. See Wiegand's comment on varieties of the next species in "The Flora of the Cayuga Lake Basin," page 32. 1926. Pinkerton in "Ferns of Missouri" (Ann. Missouri Bot. Gard. **20**: 55. 1933) says: "This species and *A. angustum* are very difficult to distinguish. It is often necessary to have the whole plant, fruiting and not too mature, to be absolutely certain. I have taken the character of the spore as my ultimate criterion."

I can not satisfactorily separate the species and their varieties and would not publish on them were it not that C. A. Weatherby has named nearly every one of my specimens. I hereby wish to express my appreciation of the difficult task of naming so many of my specimens of this complex.

Infrequent in the southern counties but frequent in its habitat. It prefers a hard, white, moist, clay soil and is usually found in low, flat woods associated with beech and sweet gum or sweet gum and pin oak. It is also found in residual soil at the base of sandstone cliffs and in sandstone soil on wooded slopes.

Mass., Ohio to Mo., southw. to Fla. and Tex.

4. **Athyrium angústum** (Willd.) Presl. (Rhodora 19: 190-197. 1917.) (*Asplenium Filix-femina* of most authors.) Map 27. Infrequent in moist, rich woods throughout the state.

Lab. to Man., southw. to s. N. E., the mts. of Pa., and Mo.

4a. **Athyrium angustum** var. **elàtius** (Link) Butters. Map 27a. This variety is infrequent throughout the state and found in rich beech and sugar maple and white and black oak woods.

Maine to Minn., southw. to R. I., N. Y., and Mo.

4b. **Athyrium angustum** var. **rubéllum** (Gilbert) Butters. Map 27b. This variety is infrequent throughout the state. The habitats of my specimens are notable because of lack of uniformity. I have one specimen from a tamarack bog and others from low, flat woods in hard, white clay soil, dry black and white oak woods, bluffs of the Ohio River, and rich, moist woods.

Newf. to Que., Ont., Minn., southw. to N. Y., Pa., Ohio, and Mo.

9. CAMPTOSÒRUS Link

1. **Camptosorus rhizophýllus** (L.) Link. WALKING FERN. Map 28. Infrequent in the southern part of the state, becoming rare to absent in the northern part. It grows in the shade in shallow soil on calcareous rocks on rocky ledges, usually along streams. It is not usually abundant unless it is found in deep shade and on rocks with considerable moisture.

Cent. Maine to Ont. and Minn., southw. to Ga. and Kans.

1a. **Camptosorus rhizophyllus** f. **auriculàtus** Clute. (Amer. Bot. 35: 102. 1929.) This is a named form infrequently found with the species in this state. It has the basal lobes of the leaves prolonged into slender tips.

10. ASPLÈNIUM L. SPLEENWORT

Frond long-attenuate at the apex.
- Stipe greenish ..... 1. *A. pinnatifidum.*
- Stipe black and polished ..... 3. *A. ebenoides.*

Frond not long-attenuate at the apex.
- Frond pinnate; stipe and rachis polished, dark reddish brown.
  - Pinnules sessile, oblong or oblong-linear, mostly 10-30 mm long, and distinctly auricled on the upper margin at the base ..... 2. *A. platyneuron.*
  - Pinnules subsessile, roundish-oblong or oval, 3-7 mm long, not auricled on the upper margin ..... 4. *A. Trichomanes.*
- Frond laxly 2-3-pinnate, ultimate segments long-cuneate at the base and finely toothed at the apex; stipe and rachis green ..... 5. *A. cryptolepis.*

1. **Asplenium pinnatífidum** Nutt. PINNATIFID SPLEENWORT. Map 29. Rare in pockets of dry soil on cliffs in the area of sandstone outcrops. Usually closely associated with *Asplenium Trichomanes* but less frequent.

Se. Pa., Ohio, and Ind. to Mo., southw. to Ga.

2. **Asplenium platyneùron** (L.) Oakes. EBONY SPLEENWORT. Map 30. Infrequent in the southern half of the state where it is restricted to the unglaciated and sandstone areas. It probably reaches its greatest size on shady slopes of some of the loess banks of the southwestern counties. In

MAP 29
Asplenium pinnatifidum Nutt.

MAP 30
Asplenium platyneuron (L.) Oakes.

MAP 31
Asplenosorus ebenoides (Scott) Wherry

the northern half of the state it is either absent or restricted again to the soils of sandstone outcrops and to the sand areas about Lake Michigan where it is only local. I have never seen it except in slightly acid soil, and when transplanted into an alkaline environment, even with great care and in a half bushel of the soil in which it grew, it gradually disappeared in a few years.

S. Maine to Ont., and Colo., southw. to the Gulf States and Tex.

2a. **Asplenium platyneuron** f. **serràtum** (E. S. Miller) Hoffm. This is a form with some of the pinnae more or less deeply and irregularly serrate. I think this is merely a nutritional form. A fine example of this form was found in Perry County by R. M. Tryon, Jr.

3. × **Asplenosòrus*** **ebenoides** (Scott) Wherry. (*Asplenium ebenoides* R. R. Scott.) SCOTT SPLEENWORT. Map 31. This fern is a hybrid between *Asplenium platyneuron* and *Camptosorus rhizophyllus*. (Slosson. Bull. Torrey Bot. Club. 29: 487-495. 1902.) Three colonies of this hybrid were discovered in Lawrence County by Ralph M. Kriebel who fully described them in Amer. Fern Jour. 23: 52-59. 1933. Mr. Kriebel is one of the best amateur botanists Indiana has ever had, and it is to his discriminating collecting that we owe not only an authentic Indiana record of this hybrid fern but also the records of three hybrid oaks and many other rare plants of Lawrence County.

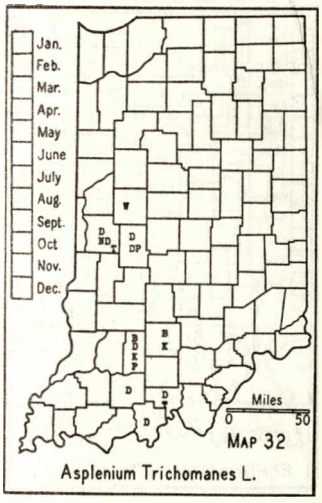
Vt. to Mo. and southw.

4. **Asplenium Trichómanes** L. MAIDENHAIR SPLEENWORT. Map 32. Infrequent to rare in pockets of soil on cliffs in the area of sandstone outcrops of the state.

Nearly throughout N. A. except in the extreme northern part and in Mex.; also in Eurasia.

5. **Asplenium cryptólepis** Fern. (Rhodora 30: 41-43. 1928.) (*Asplenium Ruta-muraria* of Gray, Man., ed. 7 and Britton and Brown, Illus.

* Amer. Fern Jour. 27: 56. 1937.



MAP 32
Asplenium Trichomanes L.

MAP 33
Asplenium cryptolepis Fern.

MAP 34
Woodwardia virginica (L.) Sm.

Flora, ed. 2, not L.) AMERICAN WALL-RUE SPLEENWORT. Map 33. My only specimens are from the rocks of the bluff of the Ohio River near Madison and in Clifty Falls State Park, Jefferson County. It was reported also from Clark and Floyd Counties by the editors of the Botanical Gazette in their list of the plants of Indiana, published in 1881. In 1939 R. M. Kriebel found it in the eastern part of Clark County.

Vt. to n. Mich., southw. to N. C., Ala., and Mo.

11. WOODWÁRDIA J. E. Smith

1. **Woodwardia virgínica** (L.) Sm. (*Anchistea virginica* (L.) Presl) VIRGINIA CHAINFERN. Map 34. This fern is infrequent to very local in the area shown on the map. Usually where it is found it is common. It grows in bogs and marshes. Its preferred habitat is old tamarack bogs and its most common associate is *Chamaedaphne.*

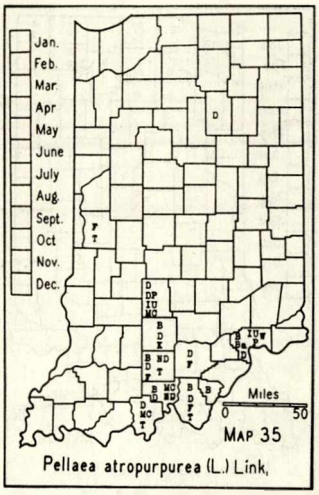
The sterile fronds of this species resemble those of *Osmunda, Dryopteris,* and *Athyrium,* but the fronds of *Woodwardia* may be distinguished by the areolae in the venation along the midrib.

N. S. to Fla., La., and Ark., chiefly along the coast; also inland in the Great Lake Region.

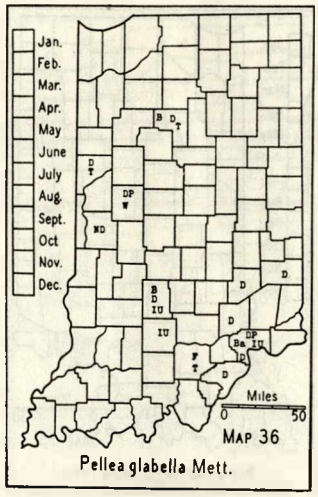
12. PELLAÈA Link CLIFFBRAKE

Stipe, rachis, and rachilla pubescent with long multicellular hairs, usually more or less densely so, especially on the rachilla, scabrous to the touch. . 1. *P. atropurpurea.*
Stipe, rachis, and rachilla glabrous or with a few scattered hairs, smooth to the touch. . . . . 2. *P. glabella.*

1. **Pellaea atropurpùrea** (L.) Link. PURPLE CLIFFBRAKE. Map 35. Infrequent to very local in shallow soil on calcareous rocks. These rocks usually are the perpendicular cliffs and ledges along streams but are often small or large detached fragments at the base of cliffs. Sometimes it is found in the seams of stratified rock outcrops only a few feet high. It grows in both shade and sun, preferring shade of medium density. My



MAP 35
Pellaea atropurpurea (L.) Link,



MAP 36
Pellea glabella Mett.

MAP 37
Cheilanthes lanosa (Michx.) Watt

Wabash County specimen was found about a mile southeast of Lagro on Hanging Rock, which is 84 feet high. It is probably extinct there now since that place has become a picnic ground.

Vt., N. Y. and n. Mich. to S. Dak., southw. to Fla., Tex., and Ariz.

2. **Pellaea glabélla** Mett. SMOOTH PURPLE CLIFFBRAKE. Map 36. This species was not separated from the preceding species even in Britton and Brown, Illustrated Flora, edition 2, published in 1913. Pickett (Amer. Fern Jour. 4: 97-101. 1914) wrote an article entitled "A peculiar form of *Pellaea atropurpurea* Link" and set forth the differences at length, but he did not give it a name until in a later article (Amer. Fern Jour. 7: 3-5. 1917.) Butters (Amer. Fern Jour. 7: 77-87. 1917) took up the subject and listed the specimens at the Gray Herbarium to show the range of the two species.

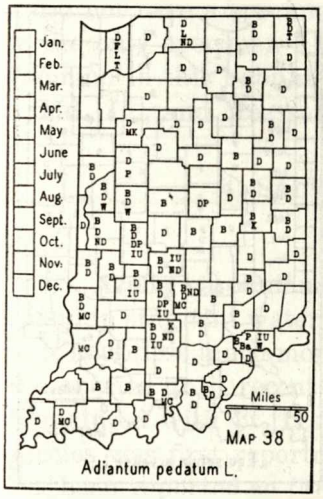
This species has the habitat of the preceding but it is less frequent. *Pellaea atropurpurea* is regarded as the southern representative of the genus in our area and has a mass distribution to the south of a line connecting Kansas and Connecticut. *Pellaea glabella* is regarded as the northern representative of the genus in our area and has its mass distribution north of that of *Pellaea atropurpurea.*

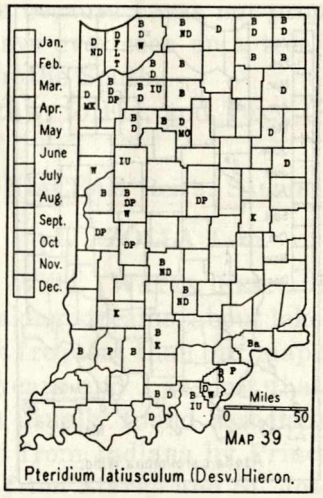
Vt., Ont. to Minn., southw. to Pa., Ohio, Ind., Mo., and Okla.

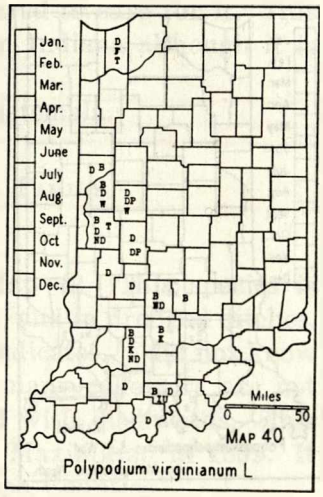
13. CHEILÁNTHES Sw. LIPFERN

Fronds bipinnate, hirsute, especially beneath; hairs straightish, jointed, and often of a rusty color, especially on the stipe.....1. *C. lanosa.*
Fronds tripinnate, tomentose with white hairs. (See excluded species no. 10, p. 1020.) ..... *C. tomentosa.*

1. **Cheilanthes lanòsa** (Michx.) Watt. HAIRY LIPFERN. Map 37. I have found this species on the exposed cliffs along White River at the McBride Bluffs about 5 miles north of Shoals in Martin County. I have also found it in three places in Perry County. It is infrequent on the stones capping the high cliffs along the Ohio River about 5 miles east of







Cannelton, on the top of low, rocky ledges about 8 miles east of Cannelton, and in the shade on a low cliff in the woods of Wm. Stahl about 3 miles south of Mt. Pleasant. The plants were numerous here but were small (mostly less than 2 dm high) because they grew in the shade.

Conn. to Kans., southw. to Ga. and Tex.

14. ADIÁNTUM [Tourn.] L.

1. **Adiantum pedàtum** L. MAIDENHAIR FERN. Map 38. Infrequent to frequent throughout the state in deep humus in many kinds of soils and with many kinds of associates. It prefers shade and shelter from wind, hence it is most often found in protected places.

Newf. to Alaska, southw. to Ga., La., and Kans., and locally westward to Utah and Calif.; also in Asia.

15. PTERÍDIUM Scop.

1. **Pteridium latiúsculum*** (Desv.) Hieronymus. (*Pteris aquilina* of Gray, Man., ed. 7, not L. and *Pteridium aquilinum* of Britton and Brown, Illus. Flora, ed. 2, not Kuhn.) BRACKEN. Map 39. Infrequent but locally common throughout the lake area in dry, sandy soil or in dry prairie habitats. It is found also locally in a few of the southern counties on wooded sandstone ridges.

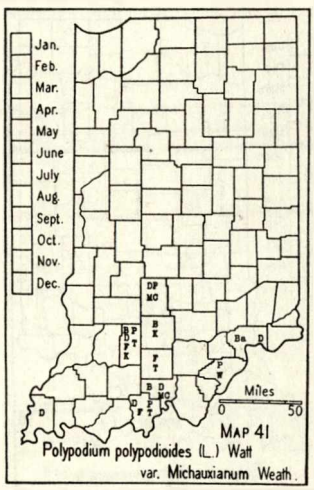
Newf. to Wis., and Wyo., southw. to D. C., W. Va., Ill., and Ariz.

16. POLYPÒDIUM [Tourn.] L.

Blades of fronds glabrous, green.....1. *P. virginianum.*
Blades of fronds densely scaly beneath, grayish. 2. *P. polypodioides* var. *Michauxianum.*

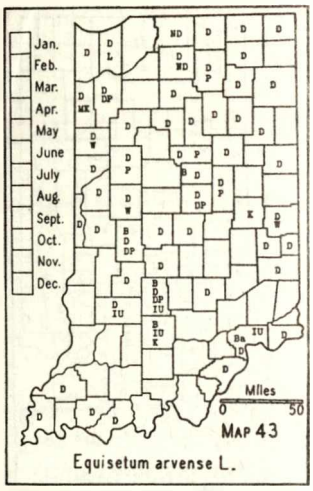
1. **Polypoium virginiànum** L. (Rhodora 24: 125. 1922.) (*Polypodium vulgare* of American authors, not L.) COMMON POLYPODY. Map 40. Local on the ledges of rocks in the area of the state where outcrops of

* Variety **pseudocaudatum** (Clute) **Maxon** is now known from Crawford and Knox Counties.



MAP 41
Polypodium polypodioides (L.) Watt var. Michauxianum Weath.

MAP 42
Azolla caroliniana Willd.



MAP 43
Equisetum arvense L.

sandstone and knobstone occur. There are, however, a few reports for it outside of this area. For example, Phinney reported it from the area composed of Delaware, Jay, Randolph, and Wayne Counties, saying: "Common. Moist woods". Van Gorder reported it from Noble County, saying: "A common plant of moist woods". Neither of these authors report the Christmas fern which occurs in their area, and, without doubt, their reports for this *Polypodium* should be referred to *Polystichum.* Bradner reported *Polypodium* from Steuben County but he also reported *Polystichum.* In this instance I think he may have had a sterile specimen of *Polystichum* and thought it was a *Polypodium.* This species was reported from the vicinity of Lake Michigan by three authors. I have always questioned these reports because my idea of the habitat of this species is that of outcrops of sandstone rocks. Doubtless Buhl had the same idea when he said (Amer. Midland Nat. **16**: 250. 1935) that this report should be deleted for lack of confirming specimens. To my great satisfaction (because I always prefer to confirm rather than to deny a report) on May 30, 1935 through the courtesy of R. M. Tryon, Jr. I was shown a colony of this species on a wooded dune in the Dunes State Park. Mr. Tryon has had this colony under observation for several years and reports that it is gradually diminishing. The plant is growing in dense shade on the north side of a high dune which is well protected from the wind. Doubtless this species was infrequent to frequent in the dunes before it had to compete with fire and civilization.

Lab., Newf. to Man., southw. to Ga., Ala., and Mo.

2. **Polypodium polypodioìdes** (L.) Watt var. **Michauxiànum** Weath. (Contrib. Gray Herb. **124**: 31. 1939.) (*Polypodium polypodioides* (L.) Watt of recent authors.) RESURRECTION FERN. Map 41. Very local in a few counties in the southern part of the state. It is usually found in large mats, clinging to almost perpendicular cliffs or on large detached fragments of rock below the cliff. I found it once in Posey County in the crotch of a large bur oak tree which grew on the border of one of the numerous sloughs in the bottoms. It grew at a height of about 10 feet above the ground but

I did not take a specimen because I was not prepared to care for it. This is the only specimen I have ever seen on a tree in Indiana although it is common in this habitat in the South.

Md., Ill., and Mo., southw. to Fla. and Tex.; Guatemala.

4. SALVINIÀCEAE Reich. SALVINIA FAMILY

1. AZÓLLA Lam.

1. **Azolla caroliniàna** Willd. WATER FERN. Map 42. This species is found in stagnant water along streams, about lakes, and in dredged ditches. It is doubtless much more frequent than our map indicates. I did not know the species until recent years and I suspect that many collectors are not acquainted with it. It is usually found associated with duckweeds. This species was first reported from Indiana by Prince Maximilian in 1839. It has been reported so far from Starke and St. Joseph Counties.

Mass., Ont. to B. C., southw. to Fla., Ariz., and Mex.; also in tropical Amer.

5. EQUISETÀCEAE MICHX. HORSETAIL FAMILY

1. EQUISÈTUM [Tourn.] L.

[Schaffner. How to distinguish the North American species of Equisetum. Amer. Fern Jour. 13: 33-40; 67-72. 1923. Diagnostic key to the species of Equisetum. Amer. Fern Jour. 22: 69-75; 122-128. 1932.]

J. H. Schaffner, our foremost authority on the genus *Equisetum*, has seen and named all of my specimens. The following key has, for the most part, been adapted from Schaffner's keys.

Stems without or with little chlorophyll, unbranched at first or permanently so, always terminating in a blunt cone.

Sheaths bright reddish brown and translucent, their teeth comparatively long, cohering in 3 or 4 broad lobes; fertile stems finally developing whorls of compound green branches; internodal ridges sometimes with rows of siliceous spinules. (See excluded species no. 13, p. 1021.) ..... *E. sylvaticum.*

Sheaths not reddish brown and translucent, their teeth not cohering in 3 or 4 broad lobes.

Teeth of the sheaths light brown, membranous, usually soon becoming green; stems soon developing whorls of 3-angled, green branches, with deltoid, membranous teeth; internodal ridges sometimes with rows of spinules. (See excluded species no. 14, p. 1021.) ..... *E. pratense.*

Teeth of the sheaths dark brown, rigid, only slightly membranous at the margins; stems withering promptly after the spores are shed; sheaths rarely slightly green; internodal ridges without spinules..... 1. *E. arvense.*

Stems green or with green branches, with or without cones.

Teeth of the lower sheaths of the main stem cohering in 3 or 4 broad lobes, comparatively long, bright reddish brown, and translucent, not deciduous; branches of the whorls prominently compound, horizontal or often curving downward, especially on the fertile shoots; stomata in bands; internodal ridges with or without 2 rows of siliceous spinules; cones not apiculate. (See excluded species no. 13, p. 1021.) ..... *E. sylvaticum.*

Teeth of the sheaths of the main stem neither united in 3 or 4 broad lobes nor bright reddish brown, deciduous or persistent.

Stems usually not branched above the ground unless the plants are injured, or the branches few, irregular and sporadic; stomata in regular rows; teeth of the sheaths or their bristle-tips usually soon deciduous, but several species with persistent teeth or the teeth forming pagodalike caps; cones with or without a point.

Teeth of the sheath persistent or only their bristle-tips deciduous, white-margined, not sharply differentiated from the sheath; sheath segments and lower part of teeth distinctly quadricarinate; stems 5-10-grooved, erect in tufts, evergreen; cones apiculate.

Ridges of internodes prominently biangulate (2 ridges to a sheath tooth), with a double row of rounded tubercles.

Sheaths cylindric, tight, often crusty, partly or completely black; stems rather large to medium, sometimes rather slender....2. *E. trachyodon.*

Sheaths campanulate, usually discoloring tardily; stems mostly very slender and small.....3. *E. variegatum.*

Ridges of internodes not biangulate, with a single row of tubercles or cross bands of silica.....4. *E. Nelsoni.*

Teeth of the sheath soon deciduous, sharply differentiated from the sheath; main stem usually tall, 10-many-grooved, with a large central cavity.

Sheaths cylindrical, short, appressed, or only slightly dilated when young, at first green, but soon turning black or gray, commonly gray with black bands above and below, often split in age; stems usually very rough, evergreen; sheath segments of the main stem tricarinate; ridges of the internodes with one row of tubercles; cones apiculate.....5. *E. prealtum.*

Sheaths more or less funnel-shaped, elongate, green, the limb normally with a narrow black band, sometimes the lower sheaths with bands of gray or black below; stems evergreen or annual; cones with or without a point.

Cones tipped with a rigid point.....6. *E. laevigatum.*

Cones rounded or the tip merely acute; limb of the long green sheath dilated upwards .....7. *E. kansanum.*

Stems usually much branched with several to many whorls of branches, rarely with only few sporadic branches; stomata in broad bands or scattered in the grooves of the internodes or only on the sheaths; teeth of the sheaths persistent; cones not apiculate.

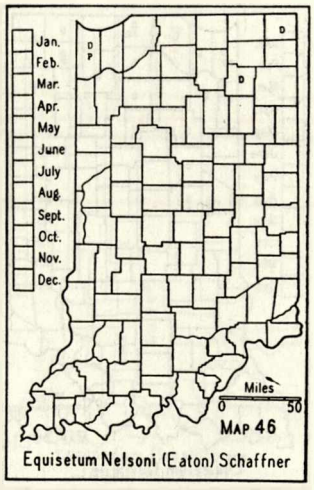
Branches hollow, usually simple, terete, both fertile and sterile stems green; plants of wet soil or growing in water, sometimes without or with only sporadic branches; sheaths of the main stem usually appressed, 15-20-toothed; stems usually many-grooved, with a very large central cavity and thin wall.....8. *E. fluviatile.*

Branches solid, simple or compound, mostly sharply 3- or 4-angled; fertile stems brown and at first without branches, soon withering or developing green branches when mature; usually in moderately moist or dry situations.

Teeth of the branches with subulate tips; branches usually 4-angled (sometimes 3-angled); fertile stems withering after the spores are shed.....
.....1. *E. arvense.*

Teeth of the branches not subulate-tipped, deltoid, merely acute or long-acute, usually white-membranous; branches generally 3-angled, very slender, fertile stems developing green branches after the spores are shed. (See excluded species no. 14, p. 1021.).....*E. pratense.*

1. **Equisetum arvénse** L. FIELD HORSETAIL. Map 43. Infrequent to frequent throughout the state. Where it is found it usually forms large colonies, especially in its preferred habitat along railroad embankments. It prefers a moist, sandy soil, usually lean in organic matter, but it is also found in moist places on the borders of bogs and along streams. It grows in both shade and sun and its appearance is so erratic and it is so widespread that I am not able to tell what controls its distribution. Once I saw



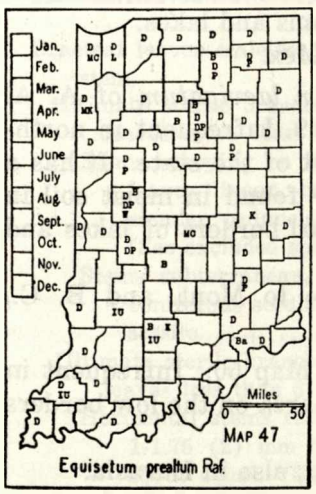
where it had almost covered a sandy fallow field in the valley of Pigeon River. The plant is extremely variable and many varieties have been named, several of which have been reported from Indiana. According to Schaffner these variations are all ecological and not worth recognition.

Newf. to Alaska, southw. to N. C. and Calif.; also in Eurasia.

2. **Equisetum trachyodon** A. Br. (*Equisetum variegatum* var. *Jesupi* A. A. Eaton). ROUGH-TOOTHED SCOURING-RUSH. Map 44. My only specimens are from Pokagon State Park from the wet, sandy shore of the east side of Lake James and from the east side of Crooked Lake, Noble County.

Que. and Ont., southw. to Conn. and Ill.; also in Eurasia.

3. **Equisetum variegàtum** Schleich. VARIEGATED SCOURING-RUSH. Map 45. My only specimen is from the grassy border of a dried-up slough in the dunes about a quarter of a mile south of Pine, Lake County (now along Clark Street in Gary about a quarter of a mile south of Lake Michigan). It has been reported also from Porter and La Porte Counties. This



MAP 50
Equisetum fluviatile L.

MAP 51
Lycopodium Selago
var. patens (Beauv.) Desv.

MAP 52
Lycopodium lucidulum Michx.

species much resembles the next one and is closely associated with it.

Lab. to Alaska, southw. to Maine, N. Y., and Wyo.; also in Eurasia.

4. **Equisetum Nélsoni** (A. A. Eaton) Schaffner. (*Equisetum variegatum* var. *Nelsoni* A. A. Eaton.) NELSON SCOURING-RUSH. Map 46. Wet, moist, or dry, sandy borders of lakes and sloughs.

N. Y. to Mich., Ind., and Ill.

5. **Equisetum preáltum** Raf. (*Equisetum hyemale* var. *affine* (Engelm.) A. A. Eaton). TALL SCOURING-RUSH. Map 47. Infrequent throughout the state. It is usually found in rather moist, sandy soil and on the slopes of the banks of streams; sometimes the habitat may even be springy. It grows in colonies, and these sometimes may extend along the bank for several rods. It rarely occurs in other habitats but is found along railroad embankments and in wet prairie habitats.

Canada to Mex.

6. **Equisetum laevigàtum** A. Br. SMOOTH SCOURING-RUSH. Map 48. Infrequent in sandy to very sandy soil in the greater part of the state. It is most commonly found on railroad embankments and less frequently in moist, sandy soil of the slopes of the banks of streams and lakes.

Conn., N. J. to B. C., southw. to N. C., La., and Mex.

7. **Equisetum kansànum** Schaffner. (*Equisetum laevigatum* of A. A. Eaton, not A. Br.) KANSAS SCOURING-RUSH. Map 49. Infrequent in northern Indiana and probably rare in the southern part of the state. It has a very wide range of habitat but is most frequently found in moist soil in prairies; it is, however, also found on the wet, marl borders of lakes and other moist habitats.

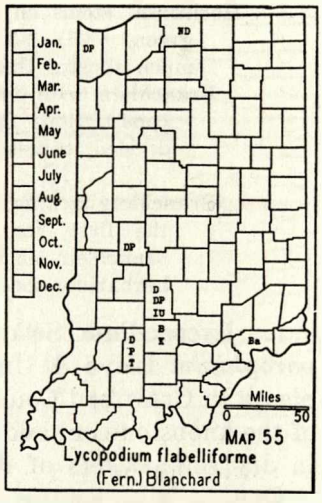
Mainly in the western Mississippi Basin, Ohio to Mont. and B. C., southw. to Mo., N. Mex., Ariz., and Calif.

8. **Equisetum fluviátile** L. WATER HORSETAIL. Map 50. Infrequent in northern Indiana in marshes and bogs, in the dune area on the low borders of sloughs, and rarely in wet prairies.

Newf. to Alaska, southw. to Va., Nebr., and Oreg.; also in Eurasia.

MAP 53
Lycopodium inundatum L.

MAP 54
Lycopodium obscurum L.



MAP 55
Lycopodium flabelliforme
(Fern.) Blanchard

6. LYCOPODIÀCEAE Michx. CLUBMOSS FAMILY

1. LYCOPÒDIUM L. CLUBMOSS

[Wilson. The identity of Lycopodium porophilum. Rhodora 34: 169-172. 1932. The spores of the genus Lycopodium in the United States and Canada. Rhodora 36: 13-19. 1934.]

Sporangia in the axils of normal leaves, not forming a well marked terminal spike.

Leaves linear-attenuate to lanceolate, entire (sometimes with a few minute serrations toward the apex), usually widest below the middle; plants yellowish green, tufted, erect or slightly decumbent at the base...1. *L. Selago* var. *patens*.

Leaves oblanceolate, widest near or above the middle, serrate or entire, arranged in alternate zones of shorter and longer leaves, the shorter ones more frequently bearing sporangia in their axils; stems bright or dark green, in loose clusters, decumbent.

Blades of leaves serrate.....2. *L. lucidulum*.

Blades of leaves entire or slightly serrate, often some of them of a linear type. (See excluded species no. 17, p. 1022.).....*L. lucidulum* var. *occidentale*.

Sporangia borne only in the axils of the upper (bracteal) leaves, forming a spike.

Bracteal leaves linear-attenuate from a distinctly broadened ovate base.....
.....3. *L. inundatum*.

Bracteal leaves scalelike, yellowish, very different from those of sterile part of the stem.

Ultimate sterile branches with their leaves mostly 5-10 mm wide, free portion of leaves more than 3 mm long.

Stems creeping on the surface of the ground with short, leafy branches, the leaves linear, bristle-tipped at apex; fertile branches terminating in a slender peduncle (1-1.5 dm long), bearing 2-4 slender cylindrical spikes. (See excluded species no. 15, p. 1021.).....*L. clavatum*.

Stems subterranean, bearing scattered upright branches resembling miniature coniferous seedlings; leaves merely acute at the apex; spikes 1-3, essentially sessile.....4. *L. obscurum*.

Ultimate sterile branches with their leaves less than 5 mm wide; free portion of leaves less than 3 mm long.

Horizontal stems rather deeply buried in the ground; branchlets bluish green, 1-1.75 (2) mm wide; leaves on ventral and dorsal sides of the branchlets about equal. (See excluded species no. 18, p. 1022.).....*L. tristachyum*.

Horizontal stems on or near the surface of the ground; branchlets yellowish green, (1.5) 2-3 mm wide; leaves on the ventral side of the branchlet much shorter than those of the dorsal side.

Branchlets with new growth clearly separated from the old growth by a constriction; branches mostly horizontal, or some erect, irregularly divided; spikes 1-3. (See excluded species no. 16, p. 1021.).....
.....*L. complanatum.*

Branchlets lacking new growth at the tips, having attained their full growth the first year, therefore lacking constrictions; branches erect, the branchlets disposed in the form of a funnel, appearing fan-shaped in herbarium specimens; spikes 1-6, usually 4.....5. *L. flabelliforme.*

1. **Lycopodium Selàgo** L. var. **pàtens** (Beauv.) Desv. (*Lycopodium porophilum* Lloyd & Underw.) Map 51. I have this variety from three places in Crawford County where I found it in dry soil in pockets of cliffs of the knobstone or sandstone, and from Martin County where it was found in dry soil pockets of the sandstone cliffs about a mile north of Shoals.

Que. to Wis., southw. to n. Vt. and Ky.

2. **Lycopodium lucídulum** Michx. SHINING CLUBMOSS. Map 52. Very local. It grows in deep humus, sometimes forming large colonies. In the lake area it is generally found in decadent tamarack bogs and southward in moist, shaded woodland, although my Clay County specimen was found in the open among rocks along Croy Creek.

Newf. to B. C., southw. to N. E., N. Y., Ind., Iowa, and Wash., and in the mts. to S. C.

3. **Lycopodium inundàtum** L. Map 53. Very local. It grows in wet, somewhat acid sandy soil, usually on the borders of lakes and in the dunes. It has also been reported from Marshall County. I have twice found it associated with cranberry and hair-cap moss. In 1937 I revisited the Steuben County station and found that it has been exterminated there.

Newf. to Alaska, southw. to N. J., Pa., Ill., Idaho, and Wash.; also in Eurasia.

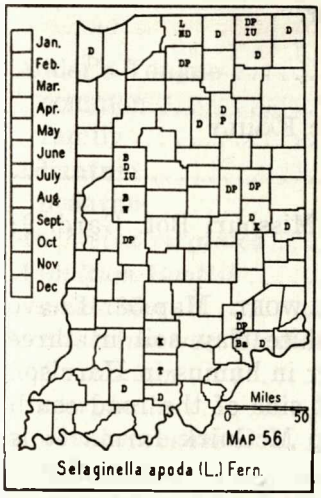
4. **Lycopodium obscùrum** L. GROUNDPINE. Map 54. Very local. In addition to my specimens it has been reported from Lake, Montgomery, Porter, and St. Joseph Counties. One of my specimens is from a small colony at the base of a north beech slope, bordering a soft maple swamp, and the other is also from a swamp bordering a lake.

My specimens are not typical and seem to be intermediate between the species and the var. *dendroideum* (Michx.) D. C. Eaton.

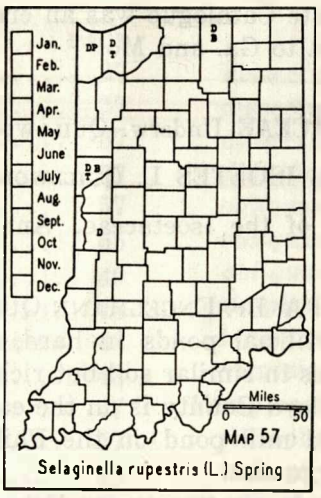
Newf. to Alaska, southw. to N. C. and Ind.

5. **Lycopodium flabellifórme** (Fern.) Blanchard. (Rhodora 13: 168-171. 1911.) (*Lycopodium complanatum* var. *flabelliforme* Fern.) Map 55. Extremely local. Found on moist, rocky slopes.

This species is regarded by many authors as a variety of *Lycopodium complanatum.* Blanchard (Rhodora 13: 168-171. 1911) made a special study of this species and *L. complanatum* in the field, and after nearly ten years' observation, concluded that the two were distinct species. Victorin (Contrib. Lab. Bot. Univ. Montreal. no. 3: 62-63. 1925) confirms Blanch-



MAP 56
Selaginella apoda (L.) Fern.



MAP 57
Selaginella rupestris (L.) Spring

MAP 58
Isoetes Engelmanni A. Br.

ard's observation of characters which seem to me also to be sufficient to regard this form as a species rather than a variety. These two species have definite geographical ranges which add to this opinion. The range of *L. complanatum* in North America extends from Newfoundland through the greater part of Canada to Alaska and southward to northern Michigan, northern Wisconsin (not reaching New England), and Washington. *L. flabelliforme* is much more southern, occurring from Newfoundland, Nova Scotia, and the lower valley of the St. Lawrence River westward to Minnesota, southward to North Carolina and Kentucky.

Newf. to Minn., southw. to N. C. and Ky.

7. SELAGINELLÀCEAE Underw.

1. SELAGINÉLLA Beauv. SELAGINELLA

Leaves comparatively few, of 2 sizes, 4-ranked, spreading in 2 planes, ovate, acute or cuspidate; plants usually a light green, of a wet or moist habitat.....1. *S. apoda.*

Leaves very numerous, alike, appressed, widely overlapping, many-ranked, linear-lanceolate, grooved on the back, ending in a slender, whitish awn; plants grayish green, of a very dry habitat.....2. *S. rupestris.*

1. **Selaginella ápoda** (L.) Fern. (Rhodora 17: 68. 1915.) (*Selaginella apus* Spring.) BASKET SELAGINELLA. Map 56. Occasionally throughout the lake area, becoming infrequent to local in the southern part of the state. It is, no doubt, more frequent than our map indicates. It prefers moist, grassy places and in the lake area it is usually in calcareous, sandy soil. In Dubois County I found it in a low woods in a hard, white clay soil with sweet gum.

Maine and Ont. to the Rocky Mts., southw. to Fla. and Tex.

2. **Selaginella rupéstris** (L.) Spring. ROCK SELAGINELLA. Map 57. Local. Found only on dry, exposed sandstone rocks and in dry sand in the dune area. It has also been reported from Montgomery County. Underwood (Proc. Indiana Acad. Sci. 1893: 257. 1894) says the report from

Gibson County in the State Catalogue was an error.

N. S. and Ont., southw. to Ga. and Mo.

8. ISOËTÀCEAE Underw. QUILLWORT FAMILY

1. ISÒËTES L. QUILLWORT

[Pfeiffer. Monograph of the Isoëtaceae. Ann. Missouri Bot. Gard. 9: 79-232. 8 pl. 1922.]

1. **Isoëtes Engelmánni** A. Br. ENGELMANN QUILLWORT. Map 58. I have found this species in artificial ponds in hard, white clay soil in three counties, and in low woods in similar soil but richer in humus in Harrison County. The colony in Floyd County is on the east side of the road south of Martinsburg in an old mill pond on the Philip McGuirk farm. It is abundant here and of large size.

Southern N. H. and Vt. to Ga., westw. to Mo.

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